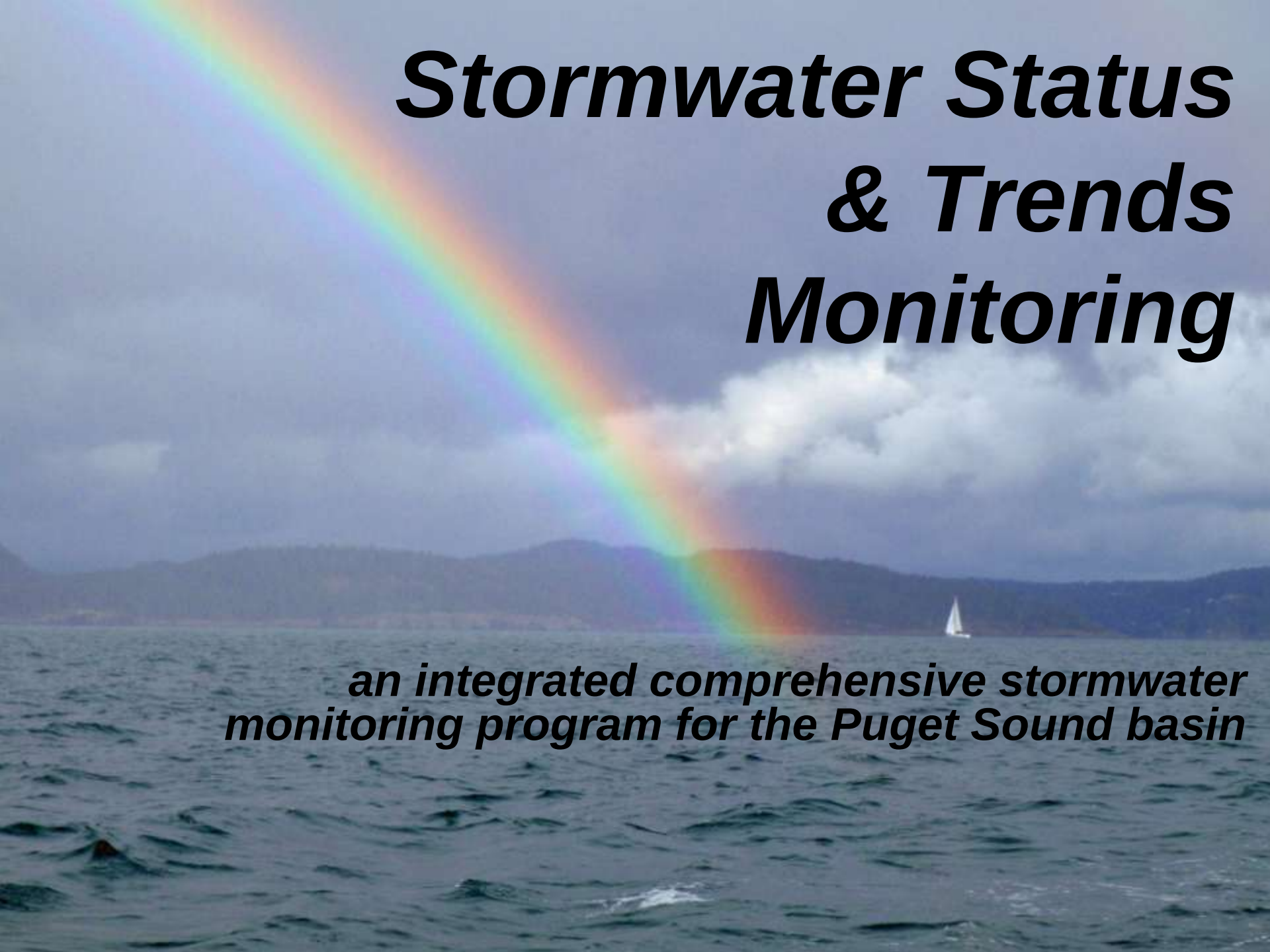
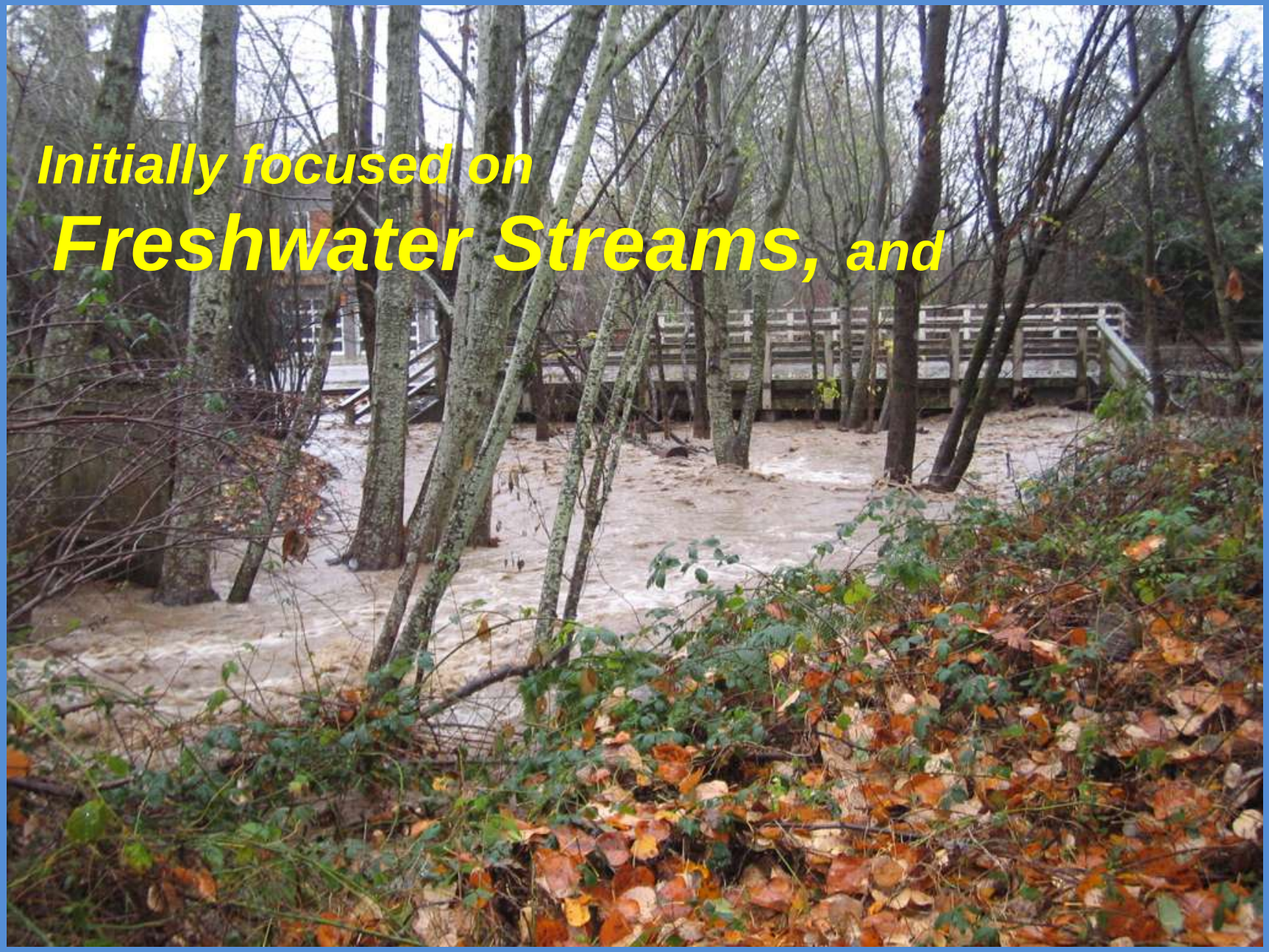


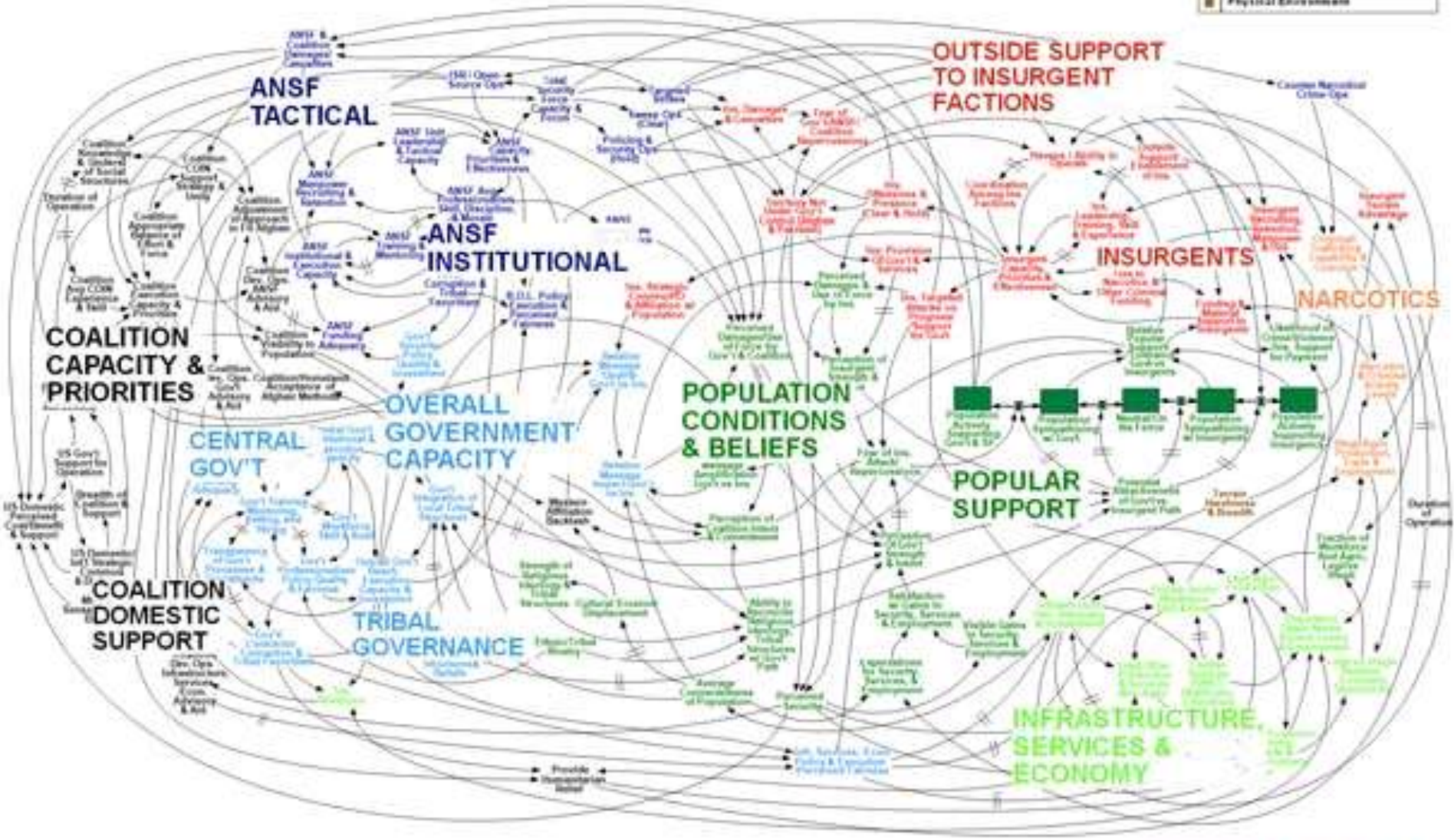
Stormwater Status & Trends Monitoring

an integrated comprehensive stormwater monitoring program for the Puget Sound basin


Initially focused on
***Freshwater Streams,* and**

Marine
Nearshore
habitats

or, the organizational structure of the NPDES permit



…or does the 'pay-in' option make you part of the Coalition of the Willing?

WORKING DRAFT – V3

PA Consulting Group
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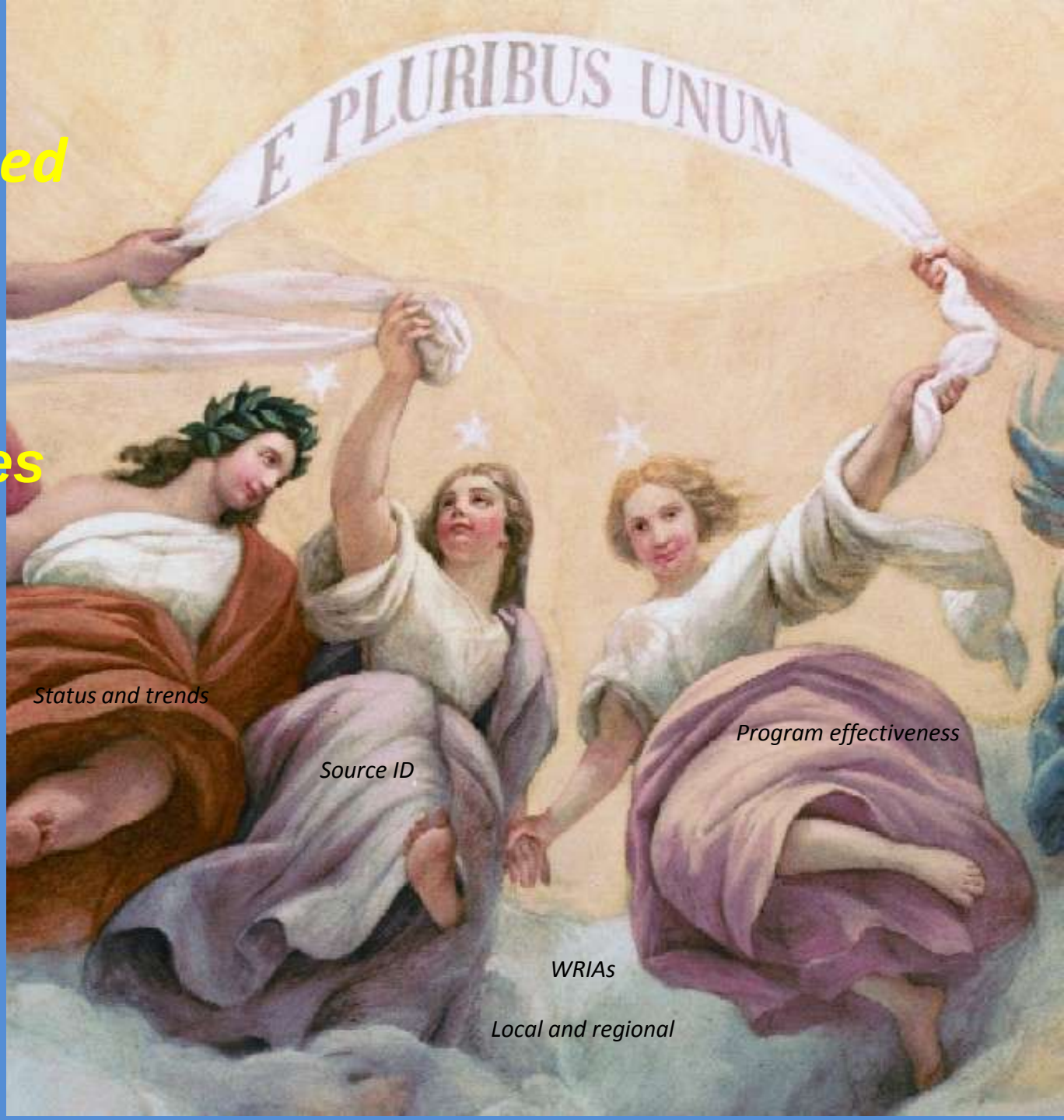
Freshwater Recommendations

Key Principles

- *coordinates and builds on existing local programs*
- *uses existing and consistent methodology for wadeable streams*
- *watershed/WRIA scale nested design*
- *link with source ID*
- *local impacts of stormwater pollution quantifiable*
- *support and link to salmon recovery and basin-wide Puget Sound Clean-up efforts*

Watershed Based

except for island counties



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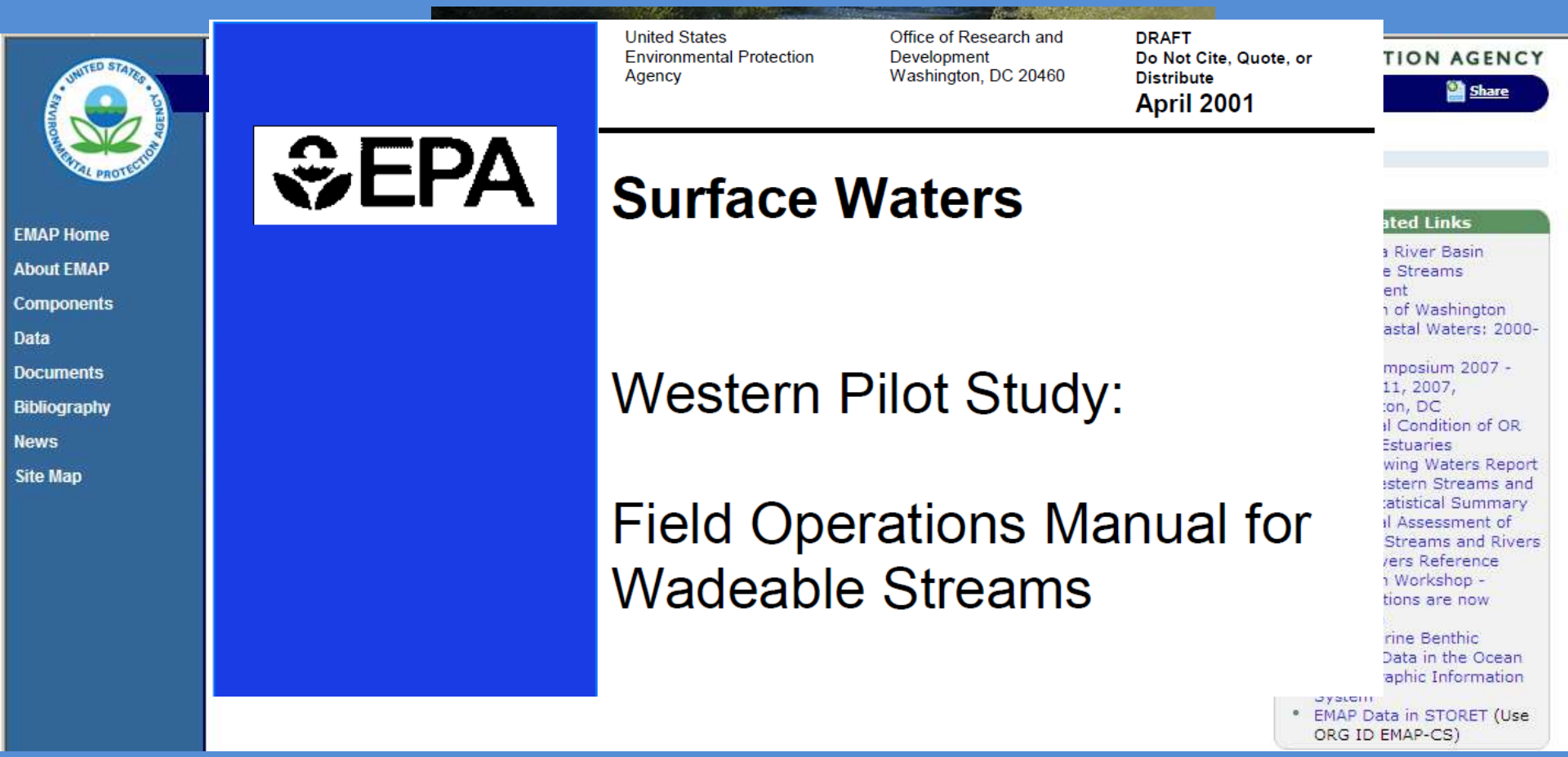
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Streams and Rivers
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Workshop -
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Data in the Ocean
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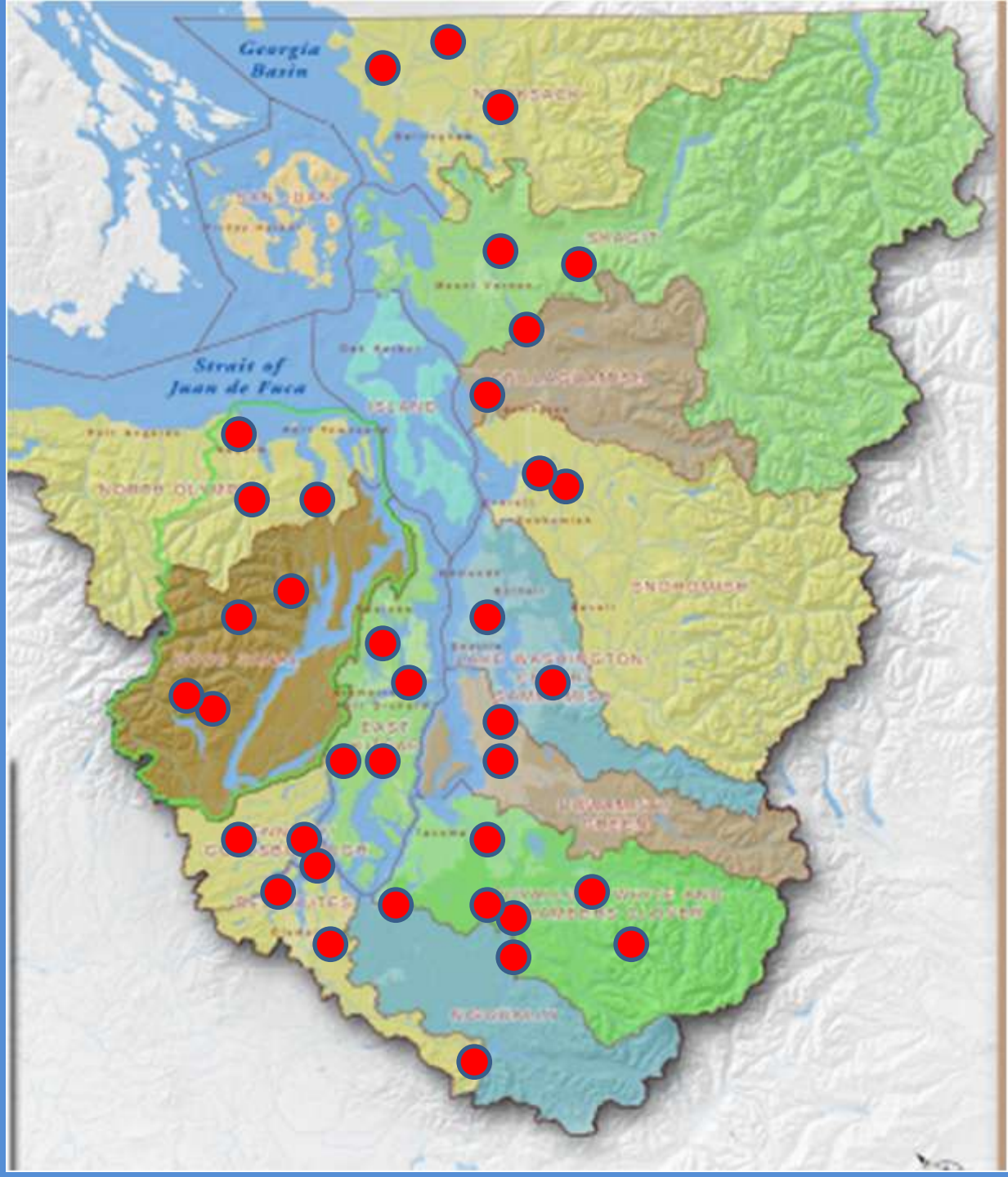
EMAP Data in STORET (Use
ORG ID EMAP-CS)

Watershed Based

For example:

50 sites from statewide master sample for the Puget Sound

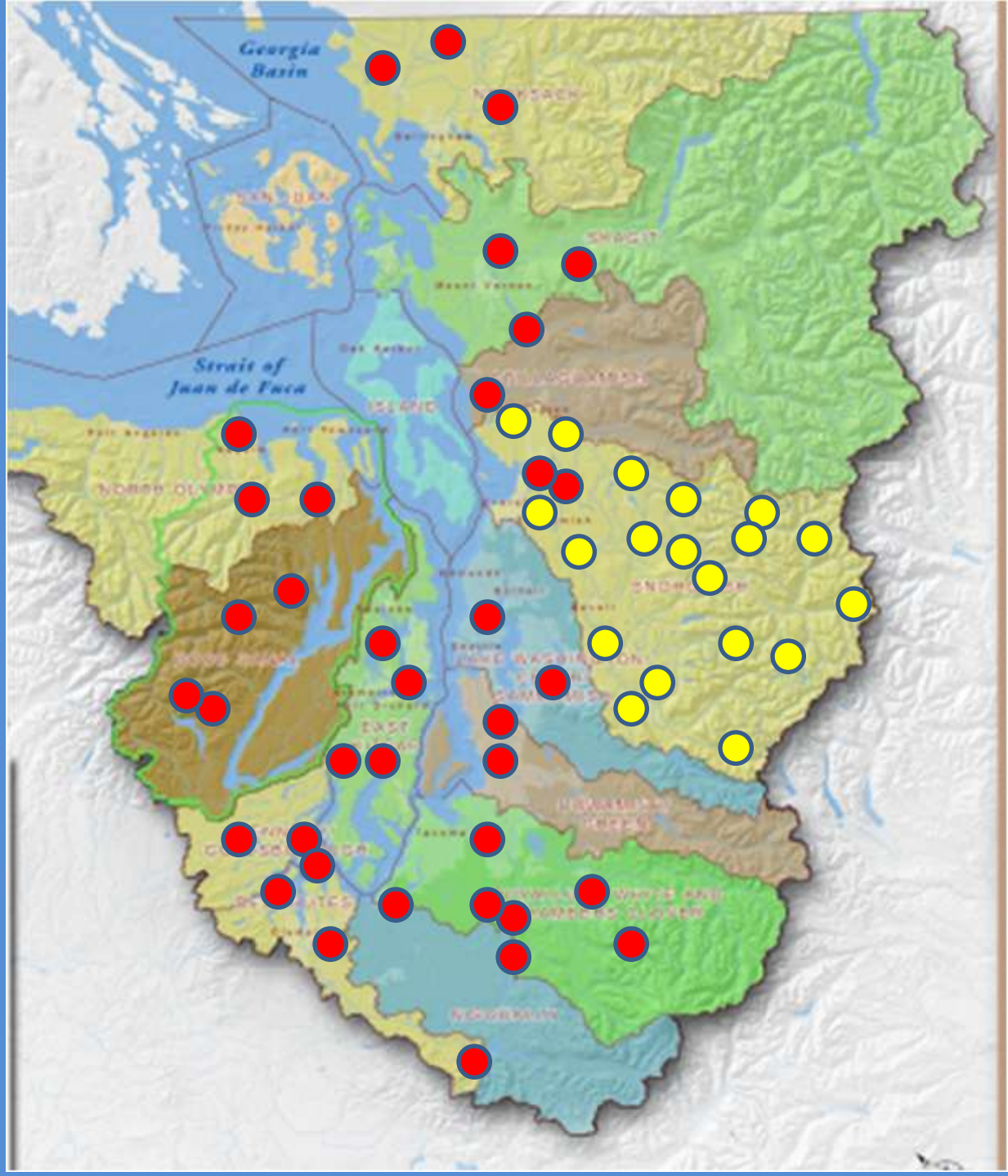


Watershed Based

e x p a n d a b e

could add additional sites from state-wide master sample in a particular *WRIA*

builds on existing local programs



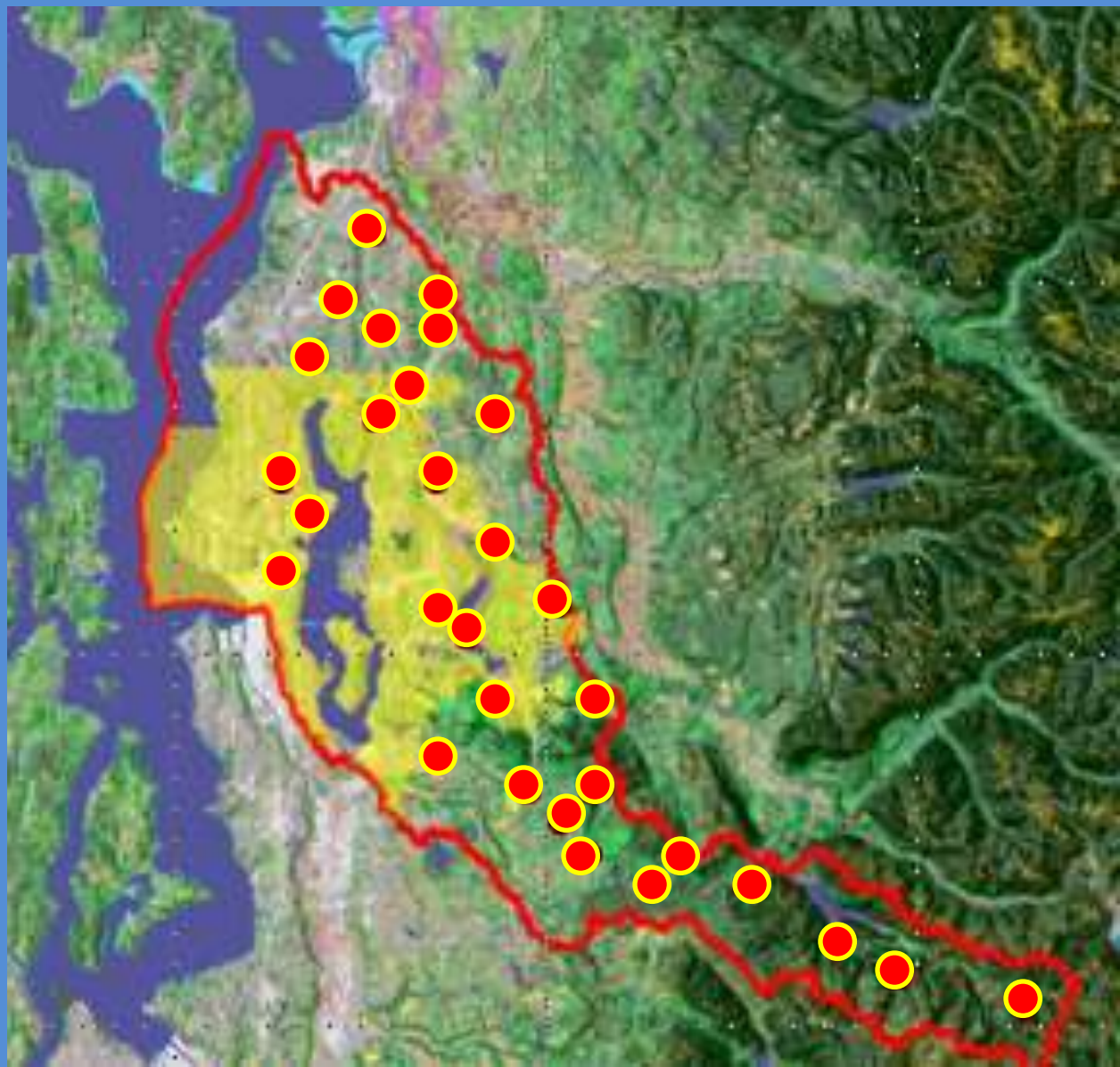
PROBABILISTIC DESIGN

Simple Random Sampling

equal weighting by area

n = 30 sites

Example for WRIA 8 Cedar-Sammamish



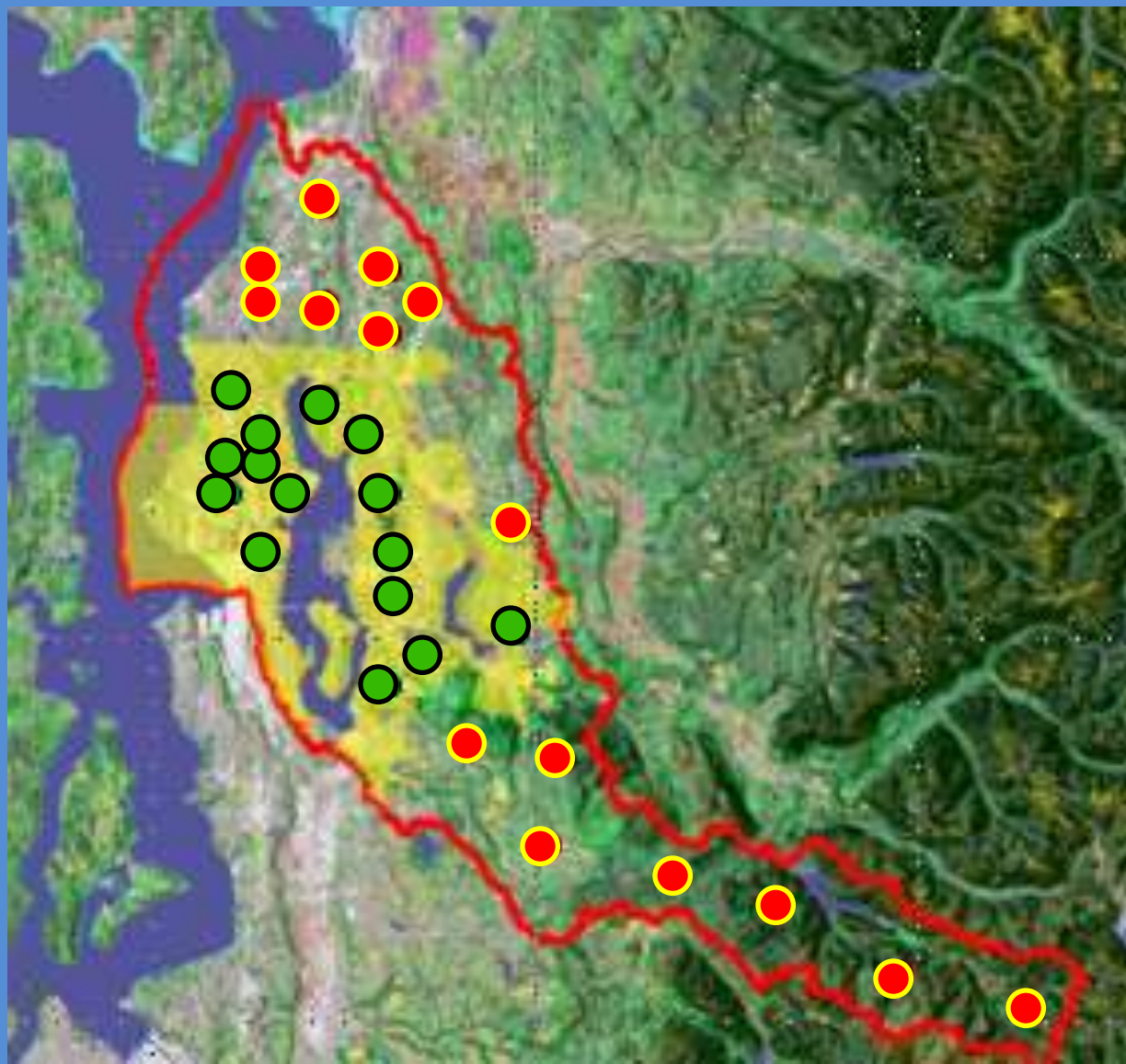
PROBABILISTIC DESIGN

Stratified Random Sampling

sampling stratified by factor related to the generation of pollutants in stormwater

n = 30 sites
20 urban
10 non-urban sites

Example for WRIA 8 Cedar-Sammamish



PROBABILISTIC DESIGN

Example, WRIA 1 Nooksack

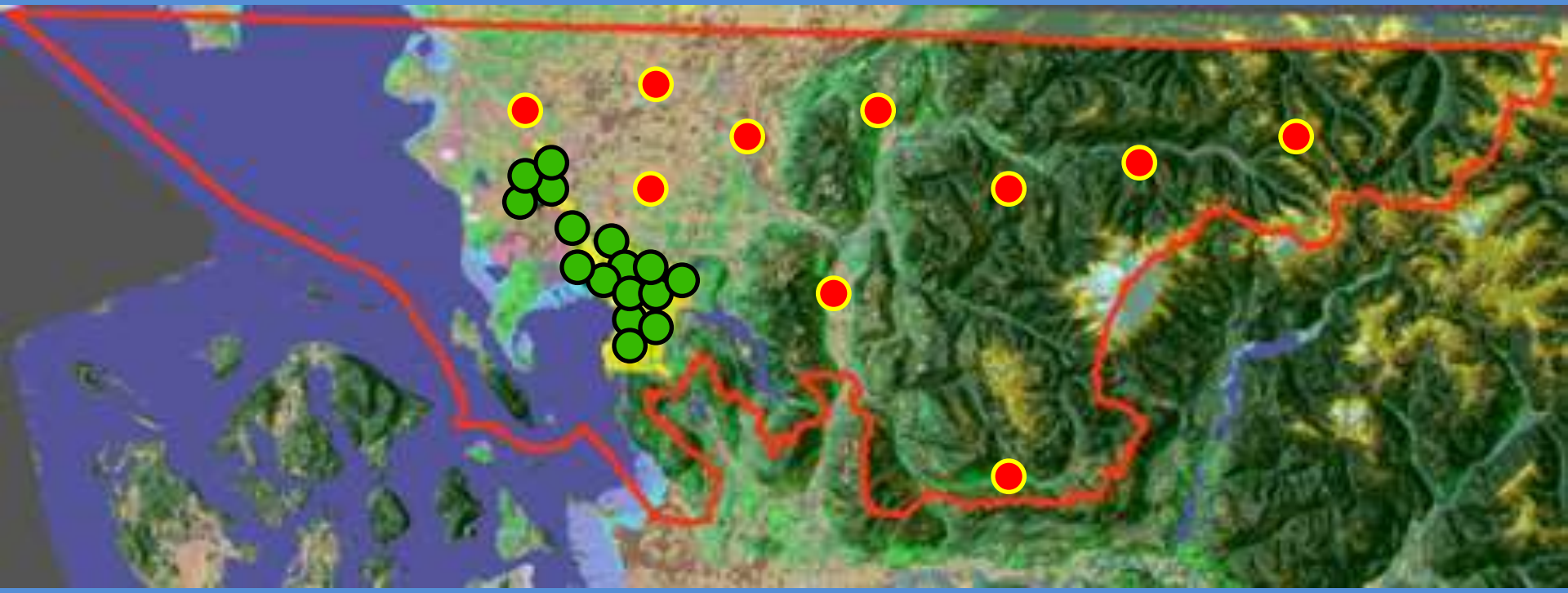
Simple Random Sampling

equal weighting by area

n = 30 sites

PROBABILISTIC DESIGN

Example, WRIA 1 Nooksack



Stratified Random Sampling

sampling stratified by factor assumed to generate pollutants in stormwater

n = 30 sites
20 urban
10 non-urban sites

Freshwater: Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Water Quality Index*	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
Aquatic Benthic Macroinvertebrates	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
Stream Physical features: channel type & shape, riparian condition, sediment, LWD,	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	No
Fish diversity, abundance	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	No

**** WQI will need to be calibrated for Puget Lowland streams***

	A	B
1	A Water Quality	
2	Station:	
3	Recreation Use:	
4	Aquatic Life (Tempera	
5	Aquatic Life (Oxygen	
6	Supplemental Spawn	
7	Ecoregion:	
8		
9		
10		Default Cu
11		Curve to U
12		
13		Da
14		10/10/07 1
15		11/14/07 1
16		12/12/07 1
17		1/9/08 12
18		2/15/08 1
19		3/19/08 1
20		4/16/08 1
21		5/7/08 9
22		6/2/08 11
23		7/9/08 10
24		8/13/08 1
25		9/10/08 1
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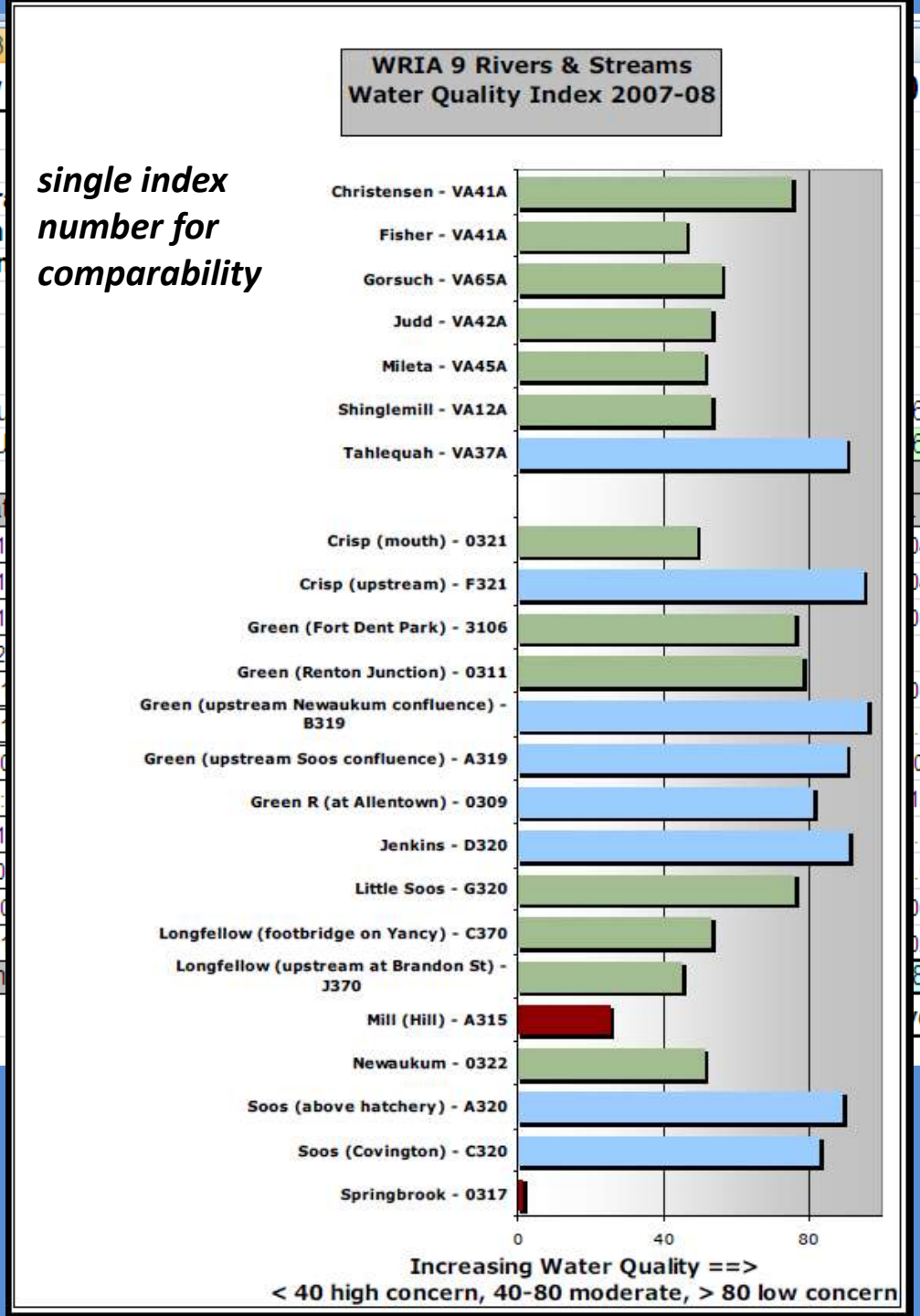

	J	K
	9.09).	
	KEY	
	Input	
	Low Concern	
	Moderate Concern	
	High Concern	
63	93	
63	93	
	Turbidity NTU	Monthly Scores
042	0.5	98
044	0.5	100
084	0.8	98
		0
087	0.5	95
.07	0.7	99
0.1	1.2	96
137	2.8	84
.11	2.1	63
.07	1.6	78
068	1	91
029	0.6	97
82	70	
verall Score:		75

NPDES annual 2-3 order streams urban / rural

Freshwater: Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Water Quality Index*	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
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Fish diversity, abundance	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	No

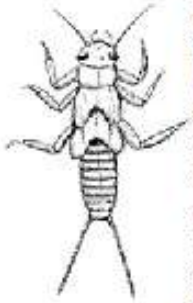
**** WQI will need to be calibrated for Puget Lowland streams***

Puget Sound Stream Benthos

Home | Analysis | Monitoring Projects | Login | About Us | Site Map

Analyzing Stream Health

This site analyzes benthic macro-invertebrate community structure to determine the ecological health of streams. Participating agencies use this site to manage, analyze and share data from their ongoing stream monitoring programs.

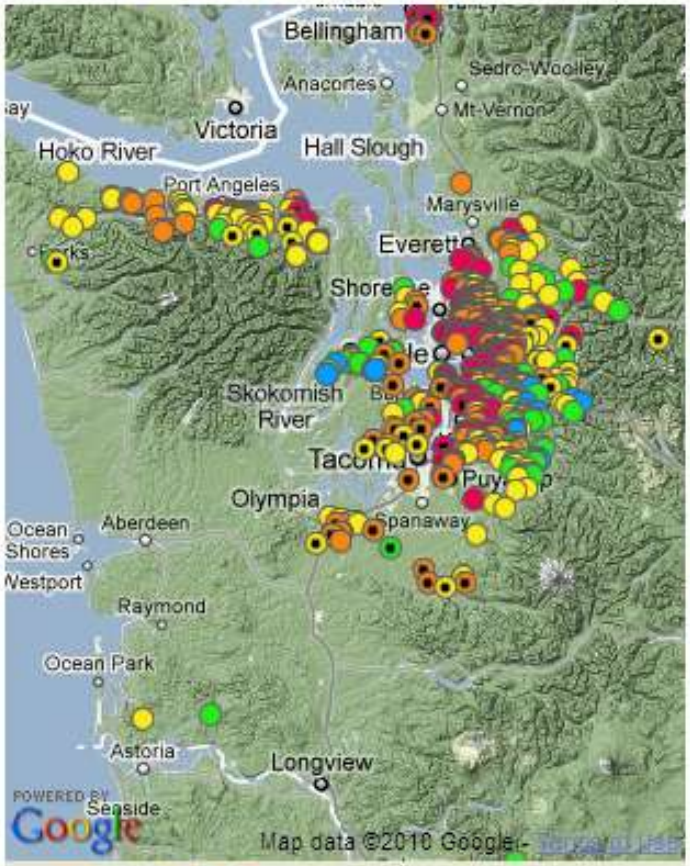


Benthic macro-invertebrates, also known as stream bugs, are animals that can be seen with the naked eye, do not have backbones and live in the **stream benthos**—in or near the streambed. They include insects, crustaceans, worms, snails, clams, etc.

Benthic macroinvertebrates are monitored because they are good indicators of the biological health of stream systems and play a crucial role in the stream ecosystem.

NPDES
annual
2-3 order streams
urban / rural

Plotting Biotic Integrity



Excellent to Very Poor

Click on biotic health markers for score details.

Click here to customize chart.

The BIBI Scoring System

We use the Benthic Index of Biotic Integrity (BIBI) scoring system to determine stream health. Since the BIBI is a standardized scoring system, it can be used to compare and rank the health of different streams.

BIBI has several variants, and we will support many of them over time. Currently, we are using Puget Sound Lowlands BIBI. This site allow you to filter the scores by a variety of parameters and then

- Plot the scores on maps
- Show the scores in tables

In the future, we will chart trends. We will also calculate scores using other scoring systems.

This program is an example of proposed regionally coordinated data collection and data management

Home | About Us | Site Map

Freshwater: Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Water Quality Index*	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
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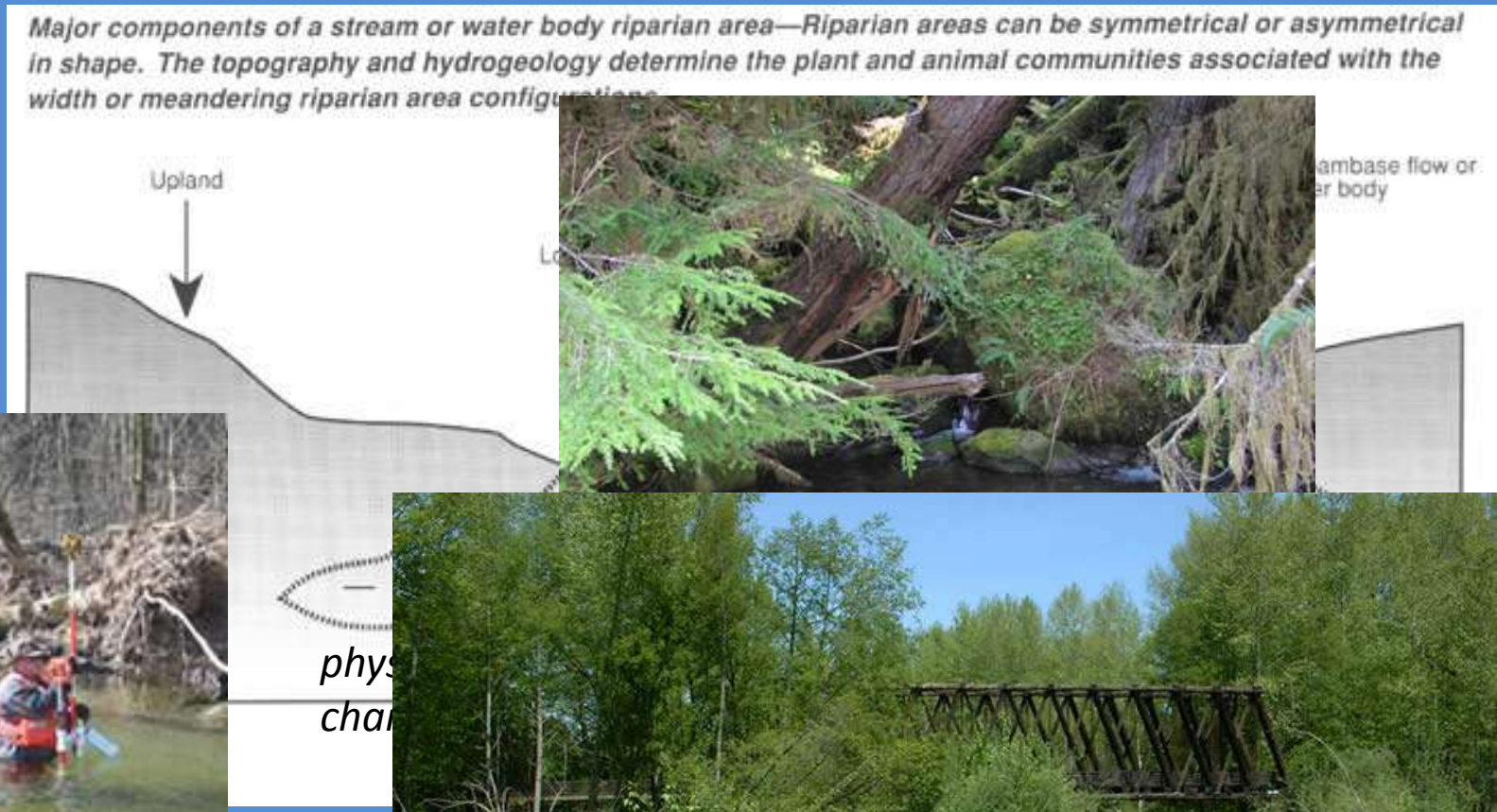
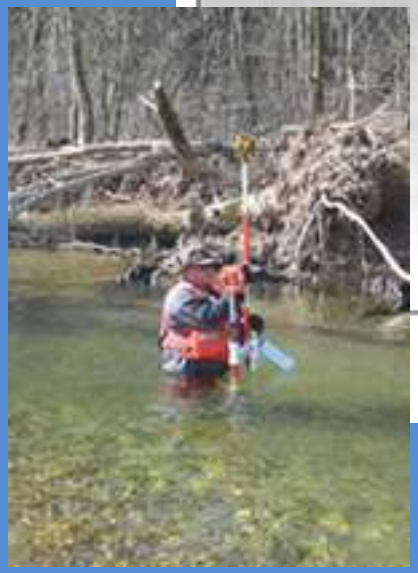
**** WQI will need to be calibrated for Puget Lowland streams***





annual
2-3 order
streams
urban / rural

large woody debris

Freshwater: Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Water Quality Index*	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
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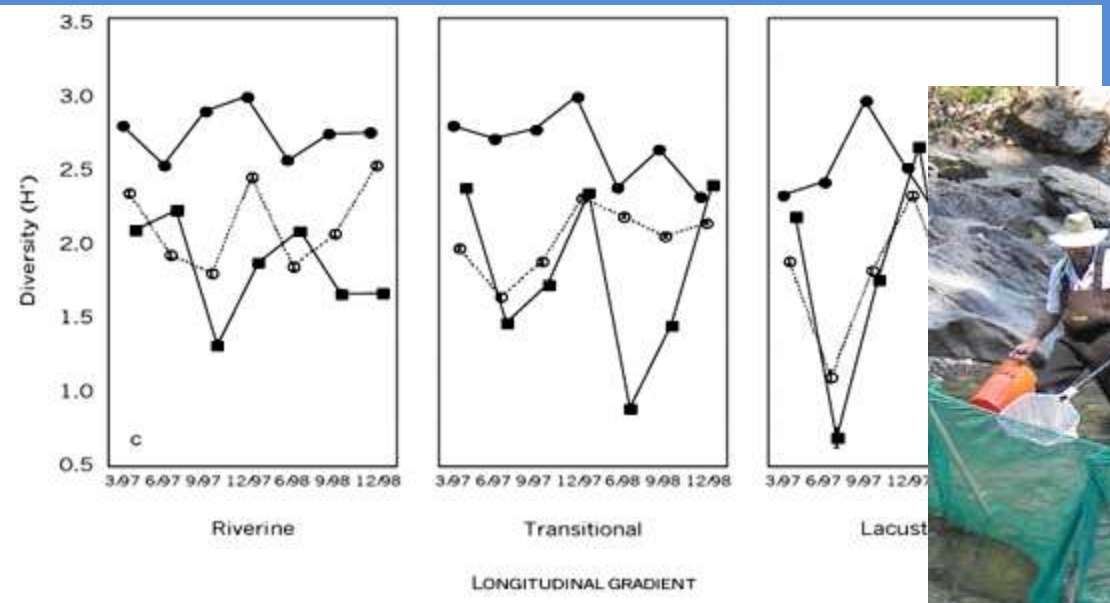
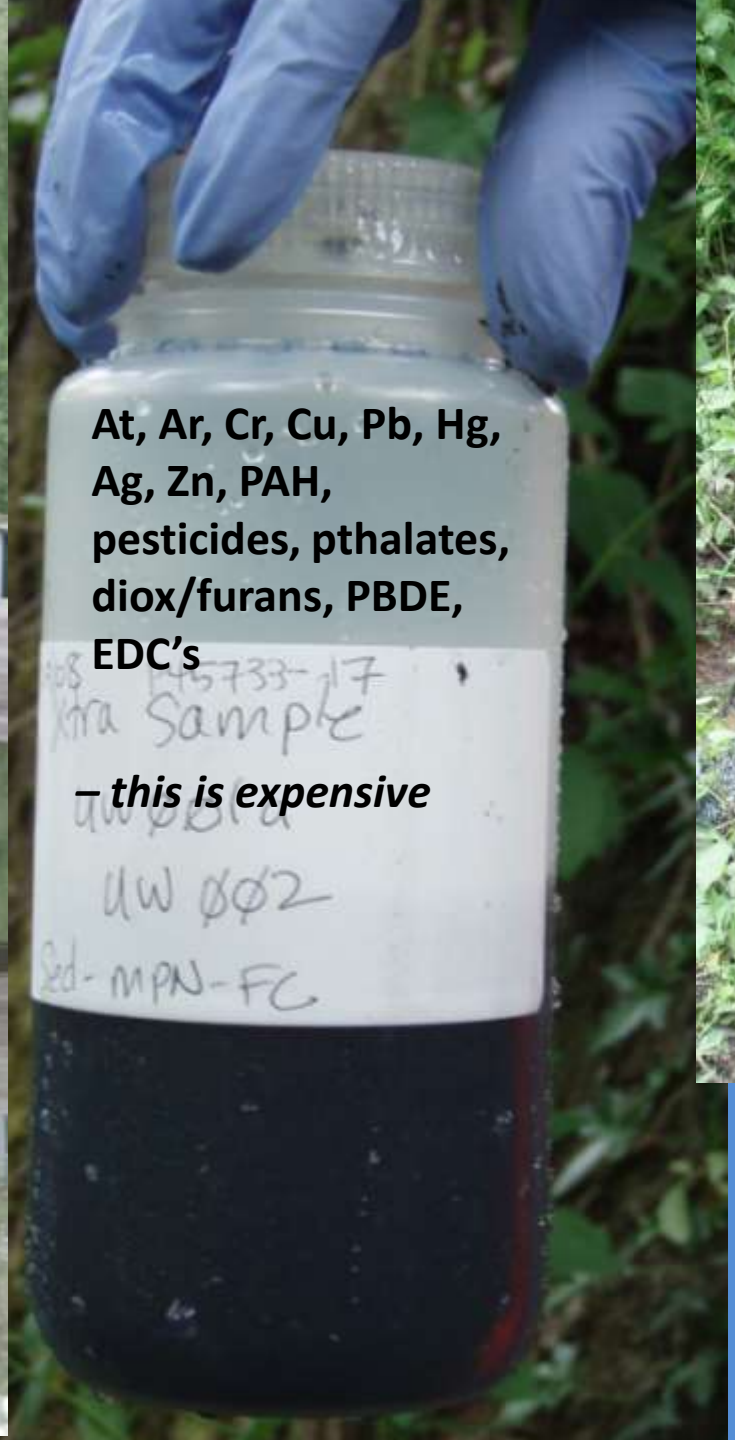


Fig. 3 — Richness (a), equitability (b) and Shannon-Wiener diversity index (c) in Itaipu R
longitudinal gradi
stretches of tributa
standard error).

annual
2-3 order streams
urban / rural

Freshwater: Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Sediment Toxics Metals: antimony, arsenic, cadmium, chromium, copper, lead, mercury, silver, zinc, PAH, Pesticides, Phthalates, Dioxins/furans, PBDE, Hormone disrupting chemicals	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
Flow	Continuous	Min. 13 Non-random, GIS analysis of current distribution over next 9-12 month	√
Temperature	Continuous	Non-random, associated with flow gauges	√
Periphyton	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√



NPDES
annual
2-3 order streams
urban / rural

Freshwater: Parameters, cont.

Parameter	Frequency	Site Selection	NPDES (√)
Sediment Toxics Metals: antimony, arsenic, cadmium, chromium, copper, lead, mercury, silver, zinc, PAH, Pesticides, Phthalates, Dioxins/furans, PBDE, Hormone disrupting chemicals	Annual	Random, UGA/rural, 2-3 order (wadeable) streams	√
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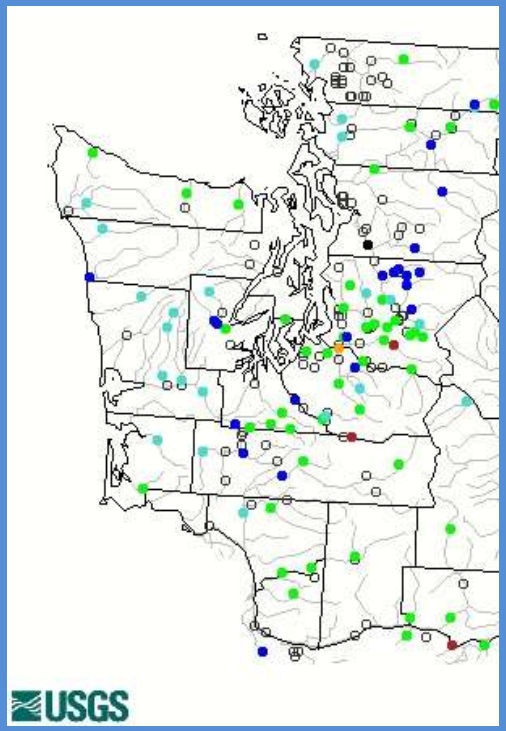

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USGS Washington Water Science Center

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Puget Sound Basin
NAWQA Study
U.S. Geological Survey
934 Broadway,
Suite 300
Tacoma, WA 98402

(gs-w naw
pugt ch@u
(253) 552-

Puget Sound Basin NAWQA

Stream Temperatures for July and August

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Project Summaries | Partnerships |

ture data were compiled as part of the Puget Sound National Water-Qu
ures can negatively affect aquatic organisms by altering food digestion
ic compounds; and hence, the interest in monitoring and tracking tren
August, typically the warmest months in the Puget Sound Basin. Includ
rs 1988-1998 collected by the U.S. Geological Survey, other agencies,
blish the data. Summary statistics and daily minimum, maximum and me

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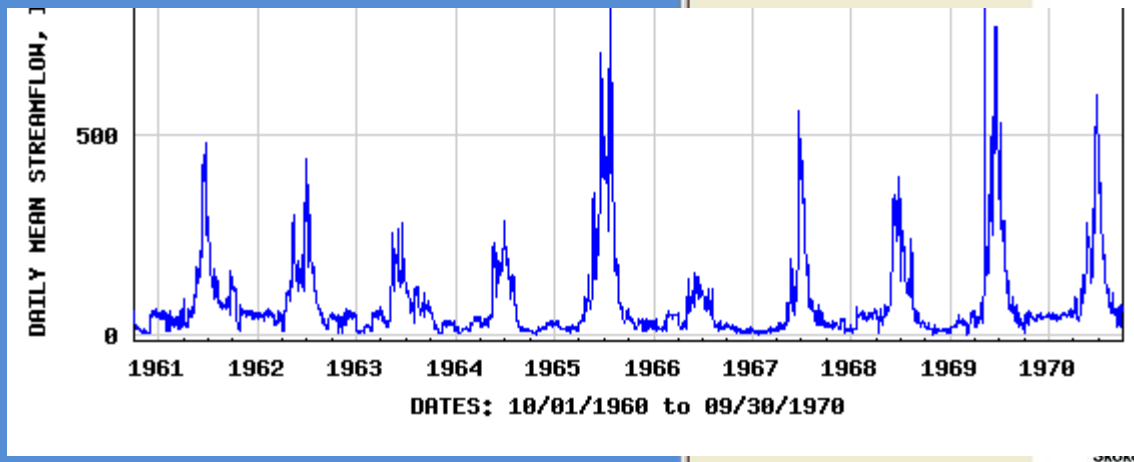
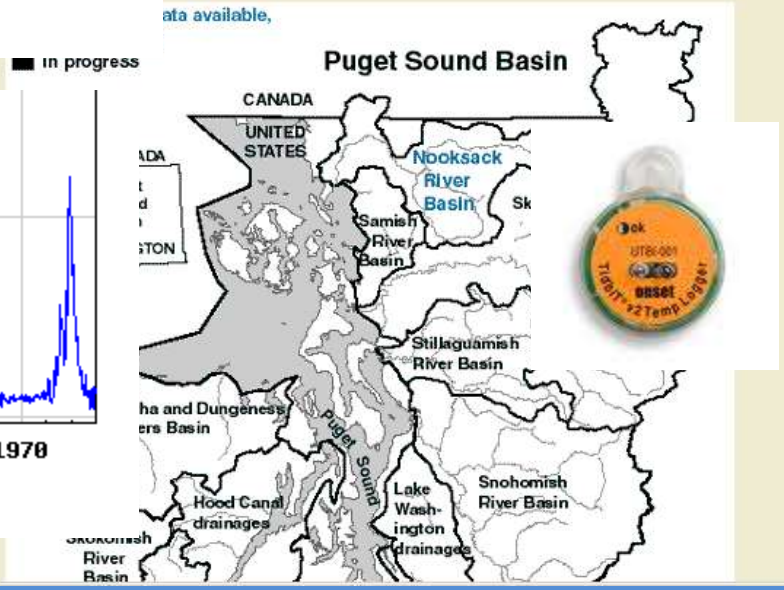
basin to display a map of stations and access data or select a riv

ata available,





Freshwater: Parameters, cont.

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Temperature	Continuous	Non-random, associated with flow gauges	√
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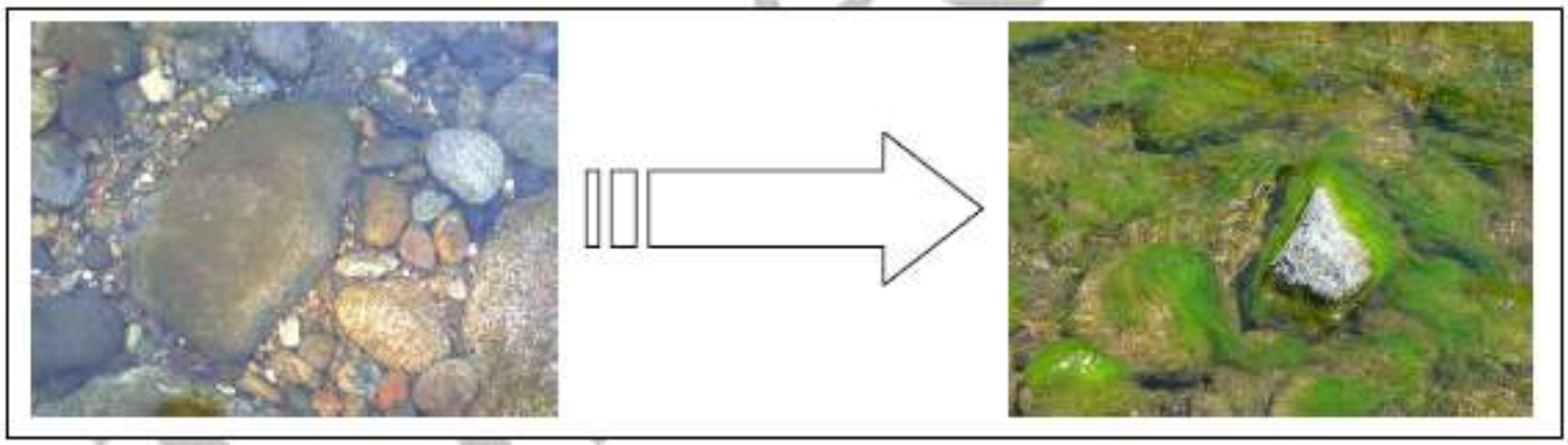
U.S. Geological Survey
Open-File Report 02-150

Revised Protocols for Sampling Algal, Invertebrate, and Fish Communities as Part of the National Water-Quality Assessment Program

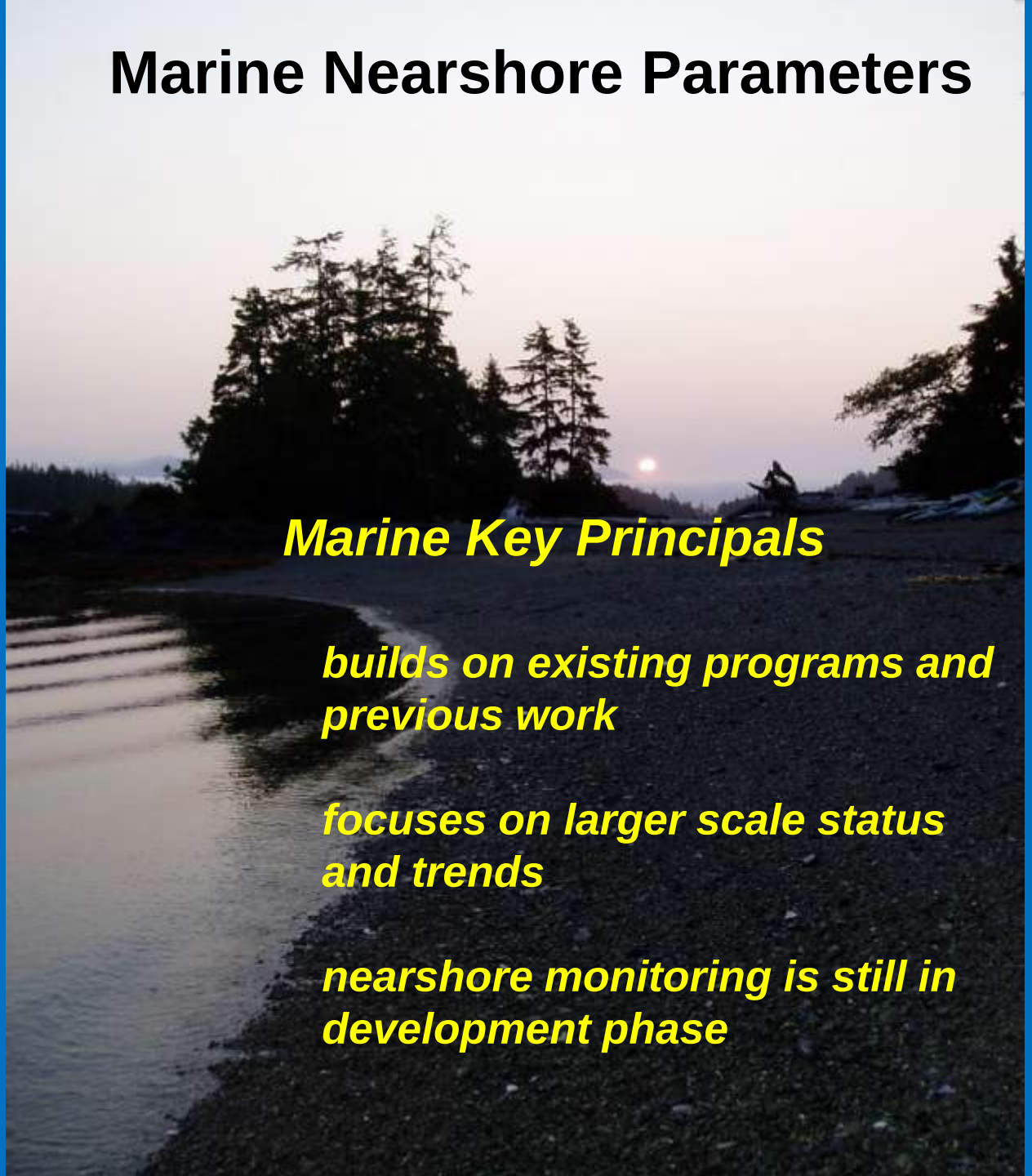
By Stephen R. Moulton II, Jonathan G. Kennen, Robert M. Goldstein, and Julie A. Hambrook

Abstract

Algal, invertebrate, and fish communities are characterized as part of ecological studies in the U.S. Geological Survey's National Water-Quality Assessment Program. Information from these ecological studies, together with chemical and physical data, provide an integrated assessment of water quality at local, regional, and national scales. Analysis and interpretation of water-quality data at these various geographic scales require accurate and consistent application of sampling protocols and sample-processing procedures. This report revises and unifies into a single document the algal, invertebrate, and fish community sampling protocols used in the National Water-Quality Assessment Program.



Marine Nearshore Parameters



Marine Key Principals

builds on existing programs and previous work

focuses on larger scale status and trends

nearshore monitoring is still in development phase

Shellfish Safety Information

Washington State Department of Health

You are here: DOH Home » EH Home » OSWP » Biotoxin Search | Employees

Only the HEALTH STATUS of beaches are shown on these maps.
For SEASONS & LIMITS visit Washington State Department of Fish and Wildlife.

Step 1
Click a county on the map

Step 2
Click a water body on the map

Step 3
Click a beach on the map until specific information is displayed including the link to WDFW regulations.

OR
Select a County
OR
Select a Beach

Not all beaches are mapped,
call your local health department/district
http://www.doh.wa.gov/lhjmap/lhjmap.htm
or (360)236-3330

2000 LandSat7 Satellite Image from WSDOT.

Western Washington

Start Over

Emergency Closures Due to Marine Biotoxins - Text Version

NEW County Beach List

Descriptions

Fact Sheet

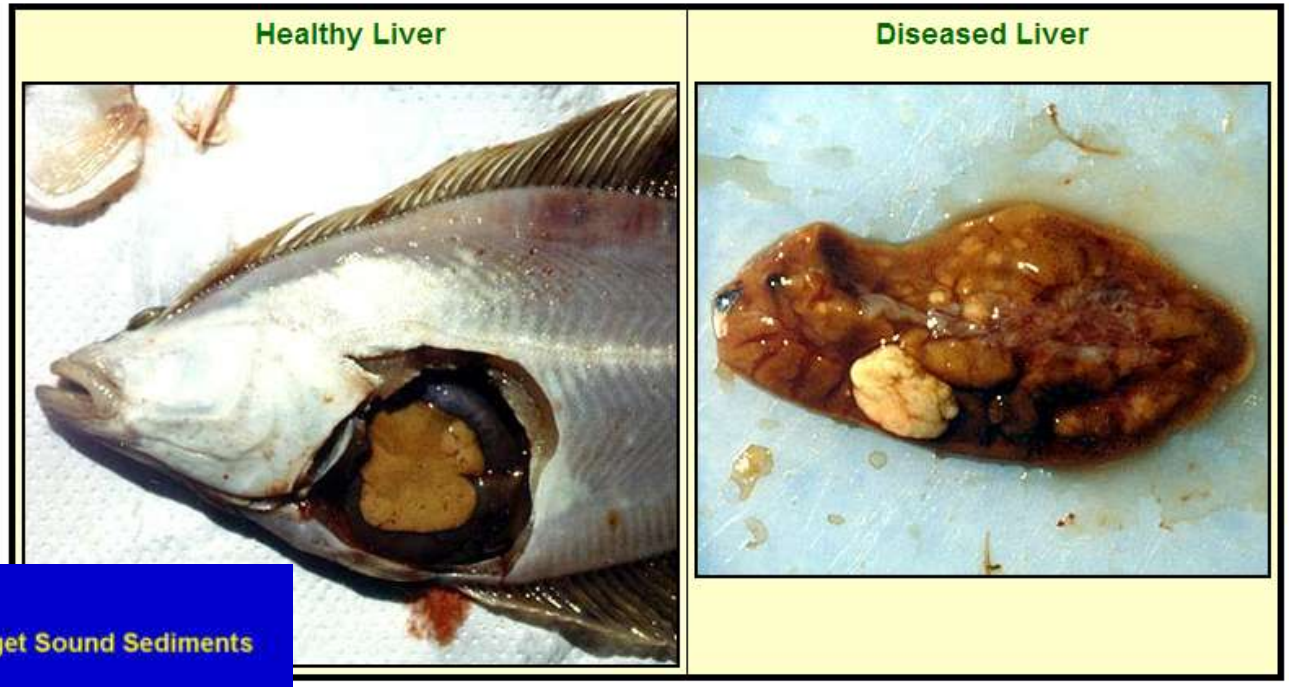
possible geographic scale coordinated with Washington Department of Health Shellfish harvest data

Marine Nearshore Parameters

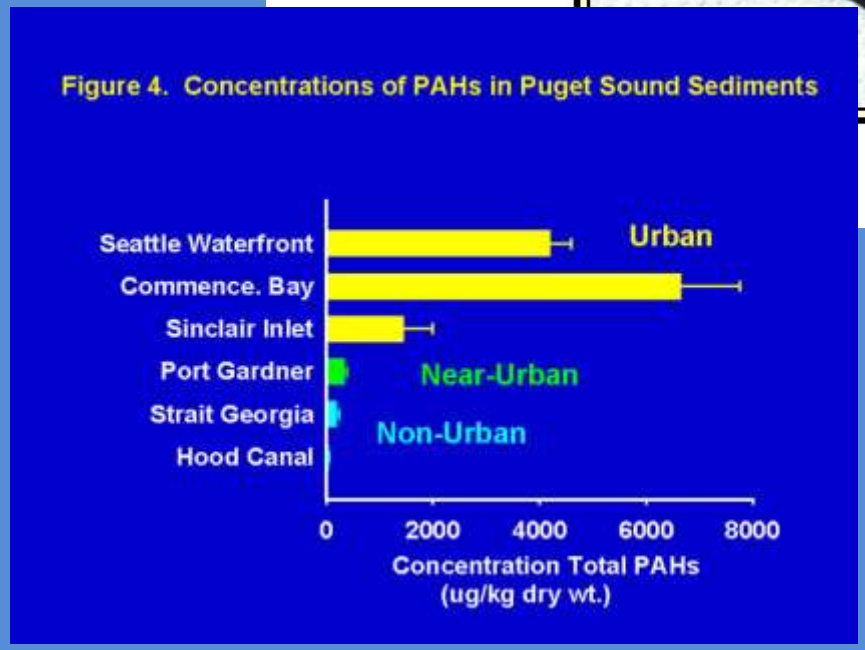
Parameter	Frequency	Site Selection	NPDES (√)
Resident Fish lesions?			no
Forage fish spawning abundance & distribution?			no
Fecal coliform	Quarterly	Randomly selected at Puget Sound scale	√
Sediment toxicity	Annually	Randomly selected at depositional areas in Puget Sound	√
Mussel Watch Bioaccumulation toxicity	Eventually annual. May need iterative approach at first – scoping/feasibility, develop a “guild” of species.	Near Stormwater Outfalls – site selection design to be determined	√

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

PSAMP Puget Sound Ambient Monitoring Program



[Return to Toxicopathic Liver Disease in English Sole]



Not part of NPDES permit

Marine Nearshore Parameters

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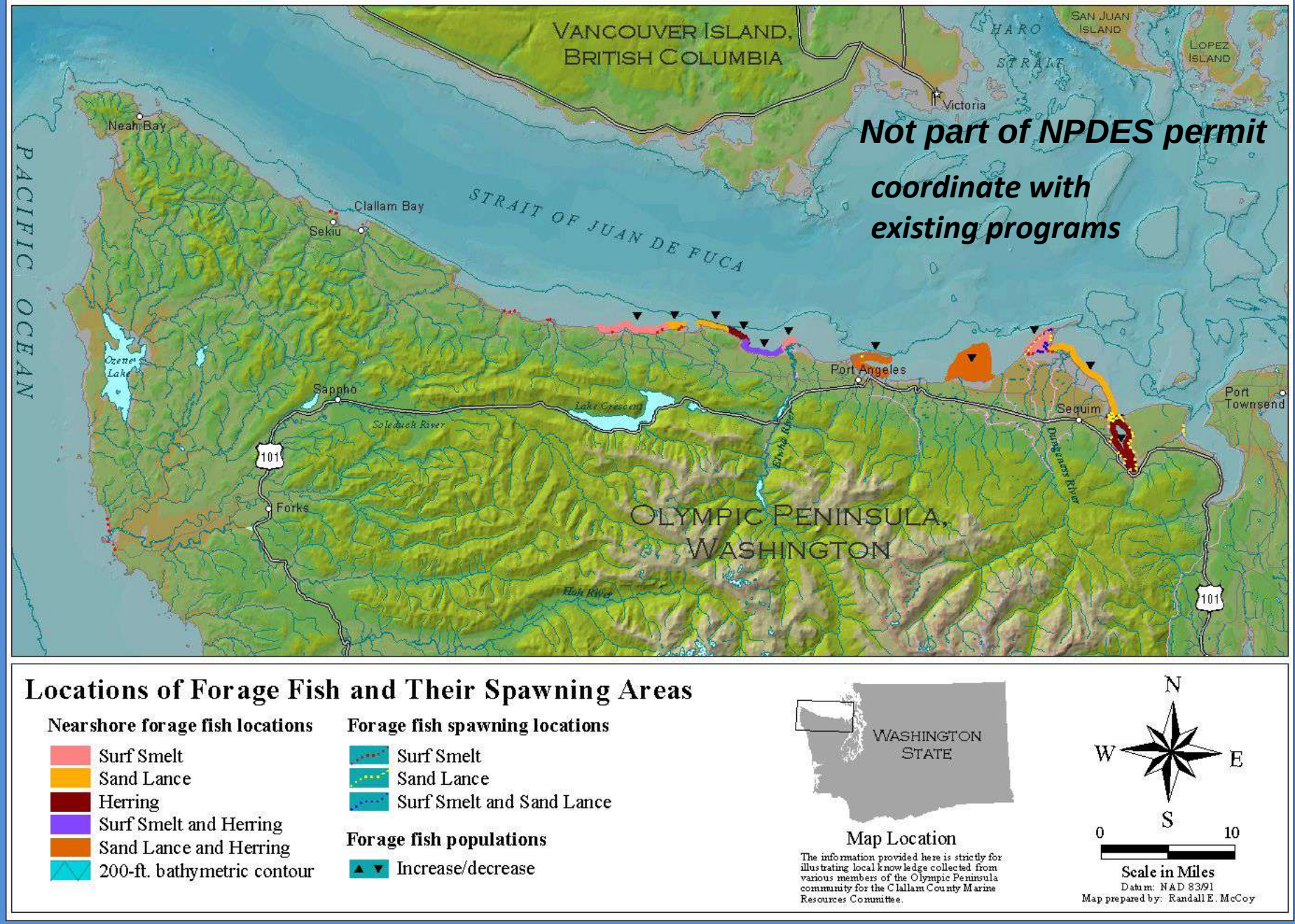
VANCOUVER ISLAND, BRITISH COLUMBIA
HARO STRAIT
SAN JUAN ISLAND
LOPEZ ISLAND
Victoria
Neah Bay
Clallam Bay
Sekiu
STRAIT OF JUAN DE FUCA
PACIFIC OCEAN
Ozette Lake
Sappho
Lake Crescent
Soleduck River
Port Angeles
Sequim
Port Townsend
Elwha River
Dungeness River
101
Forks
OLYMPIC PENINSULA, WASHINGTON
Hoh River
Not part of NPDES permit
coordinate with existing programs
Locations of Forage Fish and Their Spawning Areas
Nearshore forage fish locations
Surf Smelt
Sand Lance
Herring
Surf Smelt and Herring
Sand Lance and Herring
200-ft. bathymetric contour
Forage fish spawning locations
Surf Smelt
Sand Lance
Surf Smelt and Sand Lance
Forage fish populations
Increase/decrease
WASHINGTON STATE
Map Location
The information provided here is strictly for illustrating local knowledge collected from various members of the Olympic Peninsula community for the Clallam County Marine Resources Committee.
N
W
E
S
0
10
Scale in Miles
Datum: NAD 83/91
Map prepared by: Randall E. McCoy

Marine Nearshore Parameters

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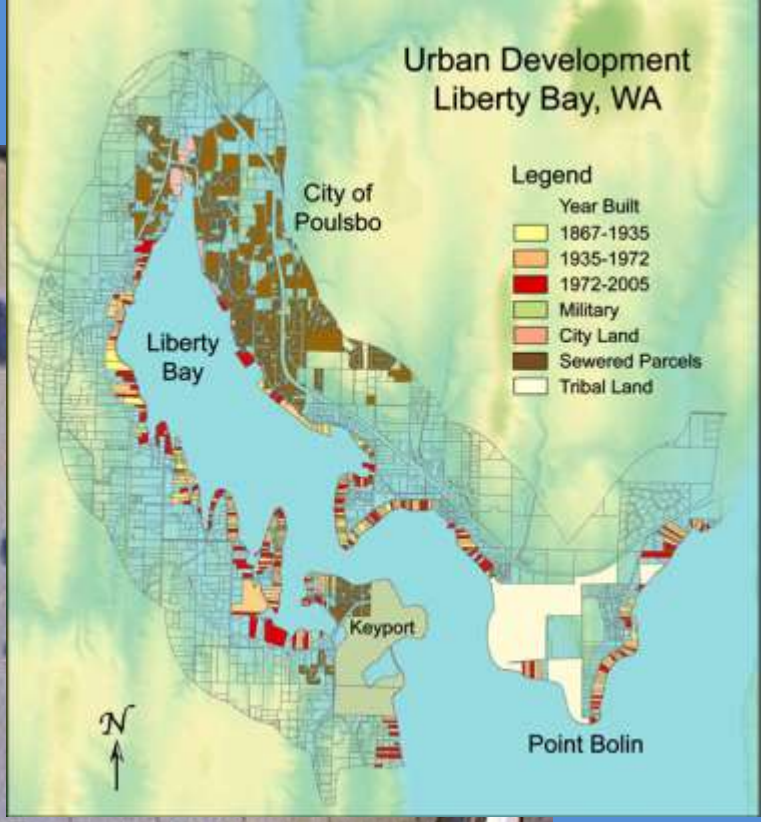

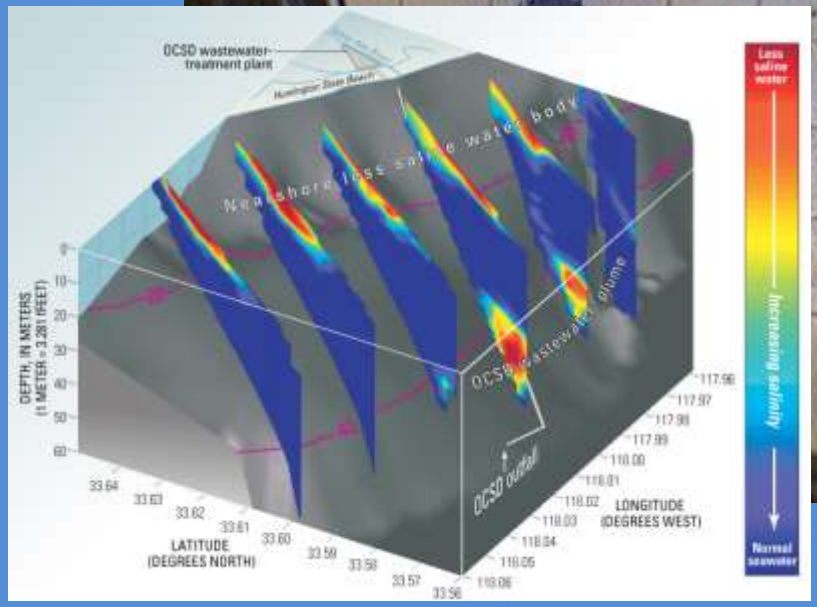

NPDES permit, probability sampling, quarterly

Marine Nearshore Parameters

Parameter	Frequency	Site Selection	NPDES (√)
Resident Fish lesions?			no
Forage fish spawning abundance & distribution?			no
Fecal coliform	Quarterly	Randomly selected at Puget Sound scale	√
Sediment toxicity	Annually	Randomly selected at depositional areas in Puget Sound	√
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NPDES
randomly selected
in depositional areas
annual

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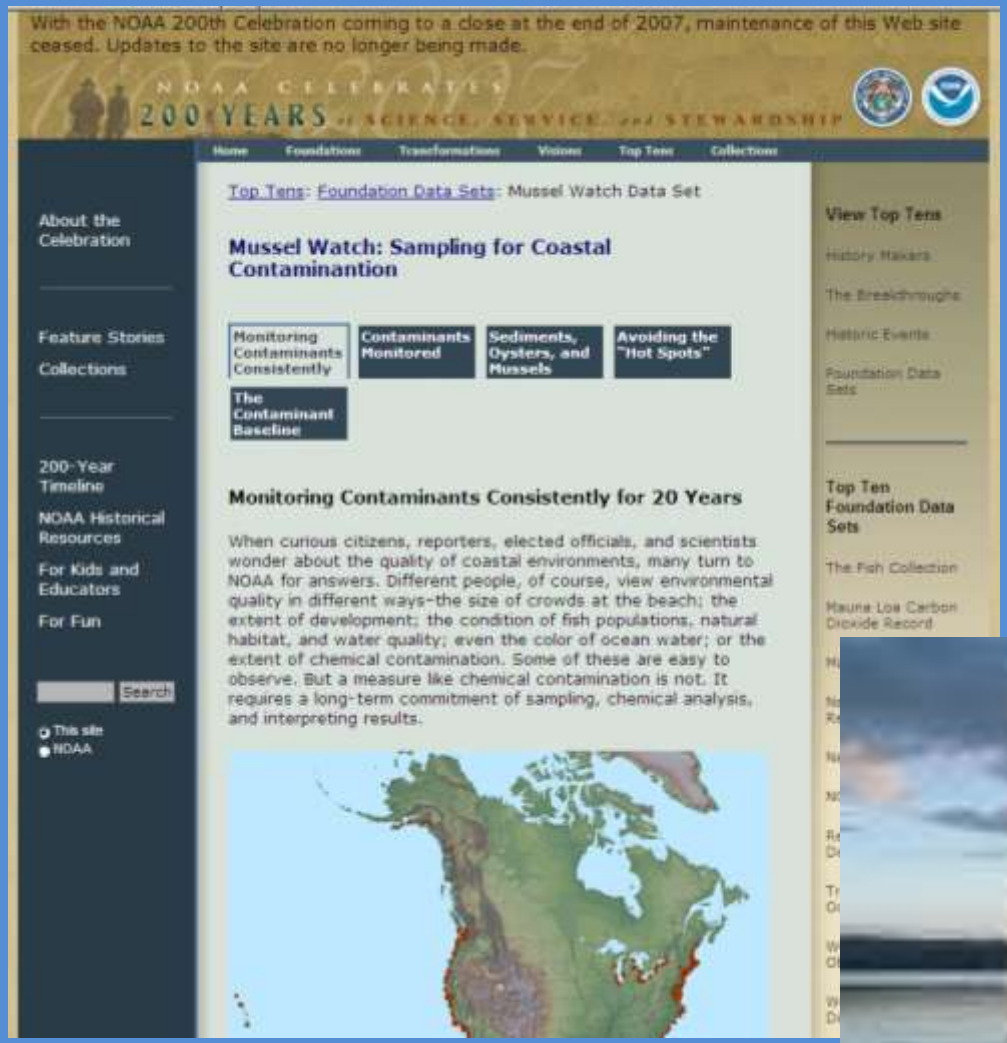
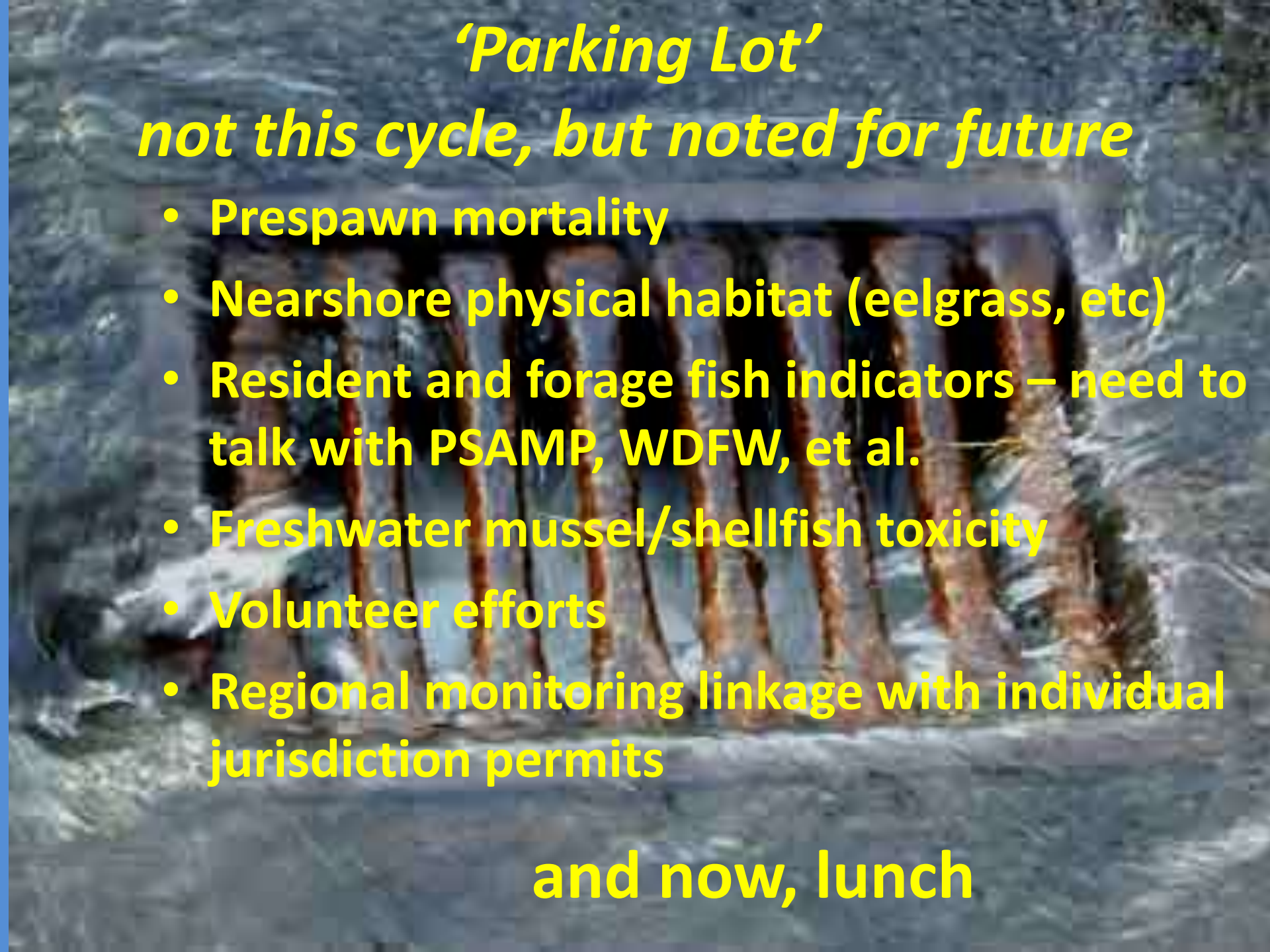


NPDES
Near stormwater outfalls locations to be determined 'eventually' annually

Proposed Status and Trends Timeline

2012 **2013** **2014** **2015** **2016**



'Parking Lot'
not this cycle, but noted for future

- Prespawn mortality
- Nearshore physical habitat (eelgrass, etc)
- Resident and forage fish indicators – need to talk with PSAMP, WDFW, et al.
- Freshwater mussel/shellfish toxicity
- Volunteer efforts
- Regional monitoring linkage with individual jurisdiction permits

and now, lunch